FOSSIL RATITE BIRDS OF THE LATE TERTIARY OF SOUTH AUSTRALIA

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Fig. 1-2

SUMMARY

Two kinds of ratite birds occur in the late Tertiary of the Lake Eyre region of Australia. These fossils are part of the Palankarinna fauna, tentatively referred to the early Pliocene, and were found in the Mampuwordu Sands at Lake Palankarinna. One specimen is described as a new species of emu, *Dromiceius ocypus*, which shows foot specialization equivalent to that of the modern emus of the continent. It is a smaller species than the living emu of the area but has foot proportions like the even smaller insular species of Pleistocene and Recent times. The other specimen is a fragmentary pelvis which is referred to the genus *Genyornis*. It is equivalent in size to the giant extinct *Genyornis newtoni* of the Pleistocene.

The fossils here reported extend the paleontologic record of the avian families Dromiceiidae and Dromornithidae from the late Pleistocene back to the Pliocene.

INTRODUCTION

The discovery of Tertiary fossil-bearing deposits in the Lake Eyre basin of South Australia was made known in 1954 by R. A. Stirton. One of the fossil assemblages found was of late Tertiary age and has been tentatively referred to the early Pliocene. It has been designated the Palankarinna fauna (Stirton, Tedford, and Miller, 1961, p. 37). In our preliminary listing of this fauna, a ratite bird was mentioned (p. 38). This may now be described as well as an additional ratite from the same formation that was obtained in the course of the field expedition of 1961.

ACKNOWLEDGMENTS

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Australian Museum and its staff. In 1961 we were especially aided by Mr. Norman B. Tindale and Paul F. Lawson and in the field by Lawson and Harry J. Bowshall. The expedition in that year was made possible by a grant from the National Science Foundation of the United States. For opportunity to examine Pleistocene and Recent emu bones I am indebted also to Edmund D. Gill and Allan McEvey of the National Museum of Victoria, Melbourne, and to H. T. Condon of the South Australian Museum.

DESCRIPTIONS

Family DROMICEIIDAE

The tarsometatarsus of an emu was obtained at the Lawson Quarry (U.C.M.P. locality V 5769) at Lake Palankarinna in 1957. It is essentially complete and lacks only the tip of the intercotylar prominence. The surface of much of the shaft is checked and in places eroded, but the distal articular area is complete and well preserved as is the hypotarsus. The shapes and relative sizes of the trochleae, the configuration of the plantar surface, the presence and location of the distal foramen, and the details of the hypotarsus all conform to those of the modern emus (*Dromiceius*) and in no respect suggest the conditions in the cassowaries (see fig. 1). The shortness and relative stoutness of the fossil is somewhat like the condition in cassowaries (*Casuarius unappendiculatus*) but in proportions it is even closer to the extinct forms of Recent and Pleistocene emus of the islands off the southern border of the Australian continent, namely *Dromiceius diemenianus* and *Dromiceius minor*.

Comparisons have been made with seven skeletons of the modern emu of the continent, *Dromiceius novae-hollandiae*, and with measurements I have taken of 14 tarsometatarsi of *minor*, including those labelled as "hypotypes" at Melbourne and with two complete tarsometatarsi of *diemenianus* in the South Australian Museum. The measurements show that the Pliocene emu was significantly shorter-legged than the modern continental bird and larger than the insular forms while possessing the relatively greater width of the latter. The Pliocene species may be known as:

Dromiceius ocypus sp. nov.

Type: Right tarsometatarsus, essentially complete. South Australian Mus. No. P 13444; Univ. Calif. Mus. Paleo. locality No. V 5769, Mampuwordu Sands, Lake Palankarinna, late Tertiary, apparently early Pliocene.

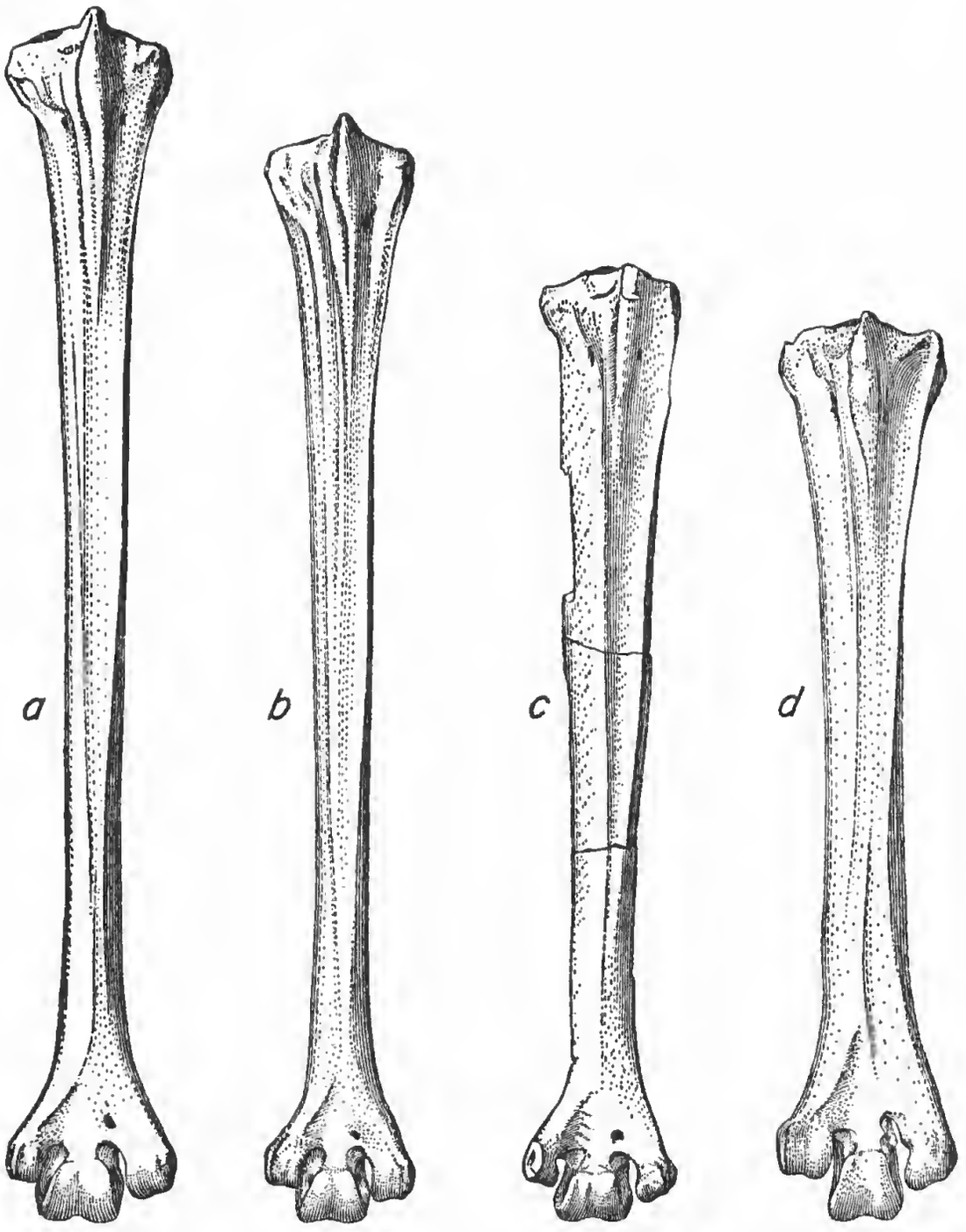

Fig. 1. Right tarsometatarsi of emus and cassowaries, plantar view, × ⅓. *a. b. Dromiceius novae-hollandiae,* large and average individuals. *c. Dromiceius ocypus,* type. *d. Casuarius unappendiculatus.*

Diagnosis: Similar in foot structure to *Dromiceius novae-hollandiae* but relative breadth of distal end of tarsometatarsus greater and linear dimensions less. Ratio of width across trochleae to length of tarsometatarsus 15.7 per cent as contrasted with 13.3 to 14.5 (average 13.6) per cent in *novae-hollandiae* and length 15 per cent less.

Analysis and comparison: Individual variation in size in emus is rather great as casual examination reveals. One can readily set aside the tarsometatarsi of individuals that are not yet fully grown by reason of the evidence of immaturity in the incomplete fusion of the tarsal region, the imperfect ossification in the area of the distal foramen and at the junction of the trochleae, and the roughness of the surfaces of the shaft. But even in bones of adults linear dimensions show considerable range of variation. For example, the coefficient of variation in tarsal length of the seven adult modern emus is 4.6 per cent. The bones of *Dromiceius minor* and of *D. diemenianus* represented in table 1, as well as the tarsometatarsus of *D. ocypus*, are those of adults. The departure of the fossil from the modern emu in tarsal length and relative width of the distal end of the tarsometatarsus was found to be significant (t test, $P = < 0.02$ and < 0.01, respectively).

Although the individual measurements of the series of *Dromiceius minor* were not recorded, the range of the 14 specimens and the values for *D. diemenianus* are such that there seems to be no possibility of overlap of either with *D. ocypus*. The latter exceeds the maximum of *D. minor* by 4.7 cm. or 16 per cent. The ratio of the width across the trochleae to tarsal length is, however, the same in *minor, diemenianus,* and *ocypus*.

Table 1

Measurements of Tarsometatarsi of Emus (*Dromiceius*) in Millimeters

	D. novae-hollandiae (7 specimens)		*D. ocypus*	*D. minor* (14 specimens)		*D. diemenianus* (2 specimens)	
	Mean and Range	Standard deviation (N-1)		Minimum	Maximum		
Total length	399 (377-431)	18·2	337·0	231·0	290·0	252·0	250·0
Distal width across trochleae	54·5 (51·0-58·9)	2·8	53·2	42·0	45·0	42·7	42·8
Proximal width	53·2 (51·1-56·7)	2·4	50·5	36·5	42·0	35·8	37·8
Least depth of shaft	13·5 (12·5-14·8)	0·85	12·6	8·4	10·5	10·4	9·9
Ratio of distal width to length (per cent)	13·6 (13·3-14·5)	0·46	15·7	15·5	16·6	17·0	17·1

Three names have been created for late Pleistocene emus from the continent of Australia by De Vis (1884, 1888, 1892). Two of these

are based on very unsatisfactory fragments. *Dromiceius queenslandiae* (De Vis, 1884) is known from a proximal part of a left femur. Hutton's report (1893) on this brings out characteristics of shape which seem to relate it either to the emus or the Dromornithidae rather than to the moas, contrary to the original view of the describer. Oliver (1949, pp. 80-88, 183) makes no appraisal of Hutton's allocation and returns *queenslandiae* to the moas. Oliver's photographs and description of this fossil compared with bones of moas (*Pachyornis*), emus, and cassowaries at hand do not convince me that his assignment is well established. In any event the bird was roughly 50 per cent larger than *Dromiceius novae-hollandiae* and thus it is wholly distinct from *D. ocypus*.

Dromiceius gracilipes (De Vis, 1892) was based on a very fragmentary distal end of a tarsometatarsus that should never have been named. Because it lacks the distal tarsal foramen characteristic of emus, it may not even belong to this group. The figure of it suggests that there has been considerable abrasion of the specimen and therefore evidence of immaturity may have been lost. The specimen could have been part of an immature emu in which the distal foramen had not yet formed, or it could be from a small cassowary. Clearly it has no close affinity with *D. ocypus*.

Dromiceius patricius (De Vis, 1888) was based on a tibiotarsus; a coracoid was also described and provisionally referred to it. The tibiotarsus was stated to reflect a heavier, more muscular leg than that of the modern emu. De Vis' description of differences in configuration leave one in doubt as to their significance, and examination of his figures of tibiotarsal fragments gives no assurance of the validity of the differences. The size of *patricius* as measured from the figures is not greater than in large individuals of modern emus, nor is the bone heavier. Much other Pleistocene material has been referred to *patricius*, including remains from the Pleistocene of the Lake Eyre region. Whether or not *patricius* or this referred material in fact represents a distinct Pleistocene form close to *novae-hollandiae* cannot be determined until the Pleistocene fossils are assembled and fully analyzed for variability and significance of differences. At present the validity of *patricius* seems questionable, but it is safe to say that it shows no features that suggest identity with *ocypus*.

The general conclusion to be drawn from the discovery and analysis of *Dromiceius ocypus* is that the structure of the foot of emus of the late Tertiary had already reached the level of specialization seen in the group today. The changes to be noted since then in

this group of birds on the mainland have been an increase in size and moderate slenderizing of proportions. The insular emus, if direct descendants, did not change proportions and either became small or represent persistence of a line of small forms.

Family DROMORNITHIDAE

At the Lawson Quarry (locality V 5769) in 1961 a fragment of a pelvis (U. C. Mus. Paleo. No. 60613) was obtained which, although very incomplete, shows features distinctive of the giant Pleistocene bird *Genyornis*. The fragment consists of the base of the left pubis and ischium surrounding the obturator foramen, the posterior and ventral parts of the acetabulum, and the ascending bar of the ischium.

These parts of the pelvis have been compared with those of emus, with photographic plates of *Genyornis newtoni* (Stirling, 1913; pls. XXXVIII and XXXIX), and with a large moa (*Pachyornis elephantopus*). The Pliocene fossil shows (fig. 2) the following features characteristic of *Genyornis* which distinguish it from *Dromiceius*: The pubis at its base, below the obturator foramen, is broader (25 per cent greater) than the ischium rather than the converse (50 per cent less); the ascending bar of the ischium is relatively longer and more slender, and the external surfaces are much more rugose. In these respects the moa is like *Dromiceius* and not *Genyornis*. The fossil from Lake Palankarinna matches *Genyornis* in size rather closely. It differs somewhat in the angle of the ascending bar of the ischium to the axis of the pubis. In *Genyornis newtoni* this is a somewhat obtuse angle posteriorly whereas in the Pliocene bird it is essentially a right angle. The bar also shows greater taper dorsally and some differences in surface configuration. These features may well suggest that a different species is involved but the fragmentary nature of the material affords inadequate basis for naming it as new. The pelvis can be referred with confidence to the genus *Genyornis*, although no comparison is possible with the one other genus of this extinct family, namely *Dromornis*, of which the pelvis is unknown.

This Pliocene fossil has significance in demonstrating that the giant birds of the family Dromornithidae existed as massive specialized ratites in the late Tertiary as well as in the late Pleistocene of Australia and that, in so far as the meagre evidence shows, they have changed little over the considerable time interval involved.

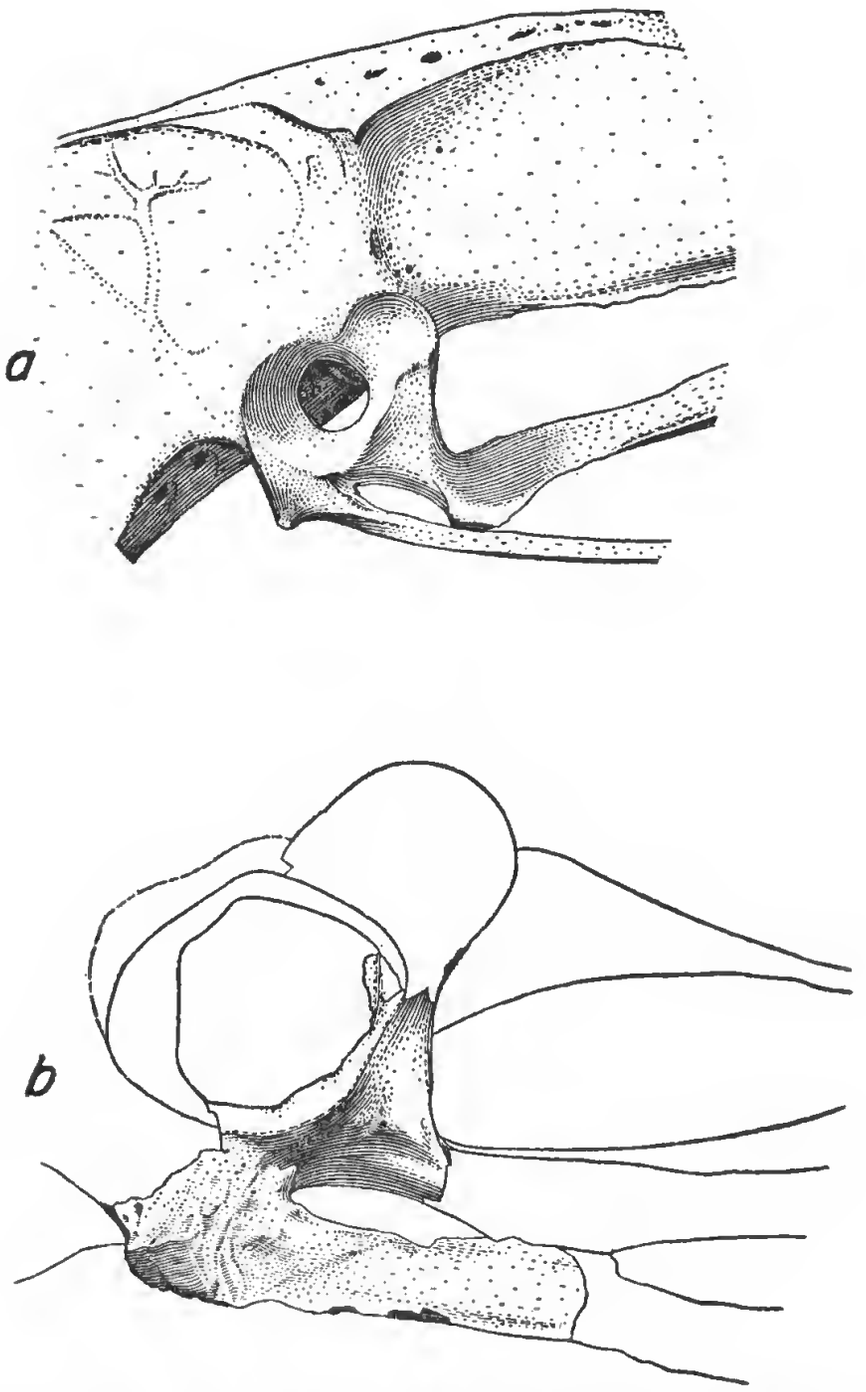

Fig. 2. *a*. Pelvis of *Dromiceius novae-hollandiae*, × $\frac{2}{5}$. *b*. Fragmentary pelvis of *Genyornis* from Lake Palankarinna, × $\frac{2}{5}$. Partial reconstruction based on figures of *Genyornis newtoni*.

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